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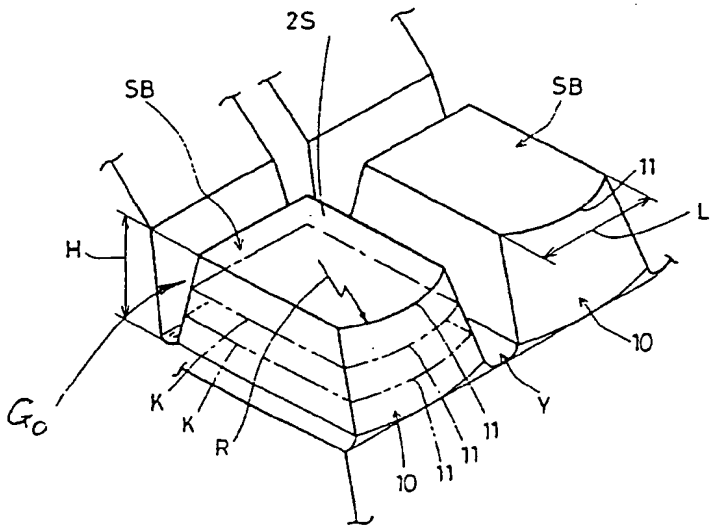
(54) **Pneumatic tyre**

(57) A pneumatic tyre comprises a tread portion provided along each tread edge with a circumferential row of shoulder blocks (SB), and each of the shoulder blocks (SB) has an axially outer side face (10) which is convexly curved in a plane parallel to the tread surface, whereby the wandering performance can be improved without causing uneven wear, rubber tear-off, deterioration in running performance and the like.

Fig.3



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[0019] In an example of the tread pattern shown in Fig.2, two inner grooves Gi are disposed one on each side of the tyre equator C, and further, axially inner lateral grooves extending from the main grooves Go to the main grooves Gi are disposed, wherein the axially inner lateral grooves are straight grooves inclined in one direction. As a result, a circumferentially continuous rib is formed between the two inner grooves Gi, and circumferential rows of middle blocks MB are formed between the inner grooves Gi and outer grooves Go. The resultant tread pattern is bi-directional. For the inner groove Gi, it is also possible to dispose one inner groove Gi along the tyre equator C.

[0020] In Fig.2, the main grooves Go and Gi are straight grooves, but various grooves, e.g. zigzag grooves, wavy grooves and the like may be used. Further, the lateral grooves Y in this example are bent grooves wherein a portion of a certain length from its axially outer end is substantially parallel with the tyre axial direction. But various configurations may be also used.

[0021] In any case, each of the shoulder blocks SB has an axially outer side face 10, an axially inner side face facing the axially outermost circumferential groove Go, and circumferential side faces facing the lateral grooves Y.

[0022] The axially outer side face 10 is convexly curved in an arc shape 11 in any plane K within a predetermined radial height range, wherein the plane K is defined as being parallel with the tread surface, and the radial height range is defined as extending radially inwardly from the top of the shoulder block SB to a certain distance which distance is at least 60%, preferably more than 80%, more preferably 100% of the radial height H of the shoulder block SB. In this embodiment, as shown in Fig.3, the curved portion extends from the top to the bottom of the block SB (namely 100% of the radial height H).

[0023] In this example, the arc shape 11 has a single radius R, and the radius R increases radially inwards from a minimum Rmin at the block top to a maximum Rmax at the radially inner end of the above-mentioned radial height range (in this example, block bottom). Preferably, the minimum radius Rmin is set in the range of from 0.5 to 1.4 times the circumferential length L of the arc 11 at the block top. Preferably, the circumferential length L is set in the range of from 10 to 30 %, usually 15 to 25 % of the tread width between the tread edges TE.

[0024] Apart from a single-radius curve, various convex curves, for example, elliptical curve, multi-radius curve and the like may be used for the arc shape 11. In this case, it is possible to increase the size of the curve, while maintaining a relationship of similar figures, from the block top to the radially inner end of the above-mentioned radial height range.

[0025] Incidentally, in a meridian section of the tyre, the contour of the tread portion is defined by a substantially single-radius arc, and intersects the contour of upper sidewall portion at the tread edges TE. The intersecting angle is in the range of from 90 to 120 degrees. The contour of the upper sidewall portion is substantially straight from the tread edges TE to the bottom of the shoulder blocks at least.

Comparison Test

[0026] Test tyres of size 11R22.5-14P (truck/bus radial tyres) all having the same structure shown in Fig.1 and Fig. 2 except for the shoulder blocks were made and measured for camber thrust.

[0027] The camber thrust was measured with a tyre cornering tester under the following conditions. The results are shown in Table 1.

Camber angle: 2 degrees
Wheel rim: 22.5 X 7.50
Air pressure: 700 kpa
Tyre load: 26.72 kN

Table 1

Tyre	Ref.1	Ref.2	Ex.1
Tread pattern	Fig.2	Fig.2	Fig.2
Wondering preventing means	None	Fig.4(A)	Fig.3
Shoulder block contour	Flat	flat	arc
Camber thrust (N)	-59	-38	-29

[0028] As explained above, in the pneumatic tyre according to the present invention, when the axially outer side faces of the shoulder blocks were curved, it became possible to decrease the absolute value of the camber thrust without decreasing the rigidity of the tread shoulder portion, and without rounding the tyre shoulder. Therefore, the wandering performance was effectively improved without causing uneven wear, rubber tear-off, deterioration in running performance and the like.

Description

[0001] The present invention relates to a pneumatic tyre provided in the tread portion with shoulder blocks capable of improving wandering performance.

[0002] In pneumatic tyres provided in the tread portion with a rigid belt, such as heavy duty tyres for trucks and buses, the rigidity of the tread shoulder portions is increased by the belt, and a wandering phenomena tends to occur when running on irregular road surfaces such as a rutted road surface.

[0003] Hitherto. therefore, in order to improve the wondering performance of a tyre, the following means are widely employed: disposing a circumferentially extending narrow groove (a) near each tread edge TE as shown in Fig.4; disposing axially extending sipes or cuts in each tread edge TE as shown in Fig.5; and providing tyre shoulders (b1) with a round contour as shown in Fig.6.

[0004] The narrow grooves (a) and sipes inevitably decrease the rigidity of the tread edge portions. Therefore, uneven wear is liable to occur. Also, tear-off of tread rubber is liable to occur. In the case of the round shoulders (bl), the ground contacting width is decreased and the tread edges are devoid of edged corners and so it is difficult to provide good running performance such as grip performance during straight running and cornering and the like.

[0005] It is therefore, an object of the present invention to provide a pneumatic tyre in which the wandering performance can be effectively improved without causing uneven wear, rubber tear-off, deterioration in running performance and the like.

[0006] According to the present invention, a pneumatic tyre comprises a tread portion with tread edges, the tread portion being provided along each of the tread edges with a circumferential row of shoulder blocks, characterised in that each of said shoulder blocks has an axially outer side face which is convexly curved in a plane parallel to the tread surface, said plane including at least the top surface of the block.

[0007] The convexly curved axially outer side face extends radially inwardly from the top of the shoulder block to a radial distance which is lot less than 60% of the height of the shoulder block.

[0008] An embodiment of the present invention will now be described in detail, by way of example only, in conjunction with the accompanying drawings in which:

Fig.1 is a cross sectional view of an embodiment of the present invention;
Fig.2 is a developed view showing an example of the tread pattern;
Fig.3 is a perspective view showing the shoulder blocks thereof; and
Figs.4, 5 and 6 show the prior arts.

[0009] In the drawings, a pneumatic tyre 1 according to the present invention comprises a tread portion 2, a pair of sidewall portions 3, a pair of bead portions 4 each with a bead core 5 therein, a carcass 6 extending between the bead portions 4, and a belt 7 disposed radially outside the carcass 6. The tyre shoulder is not rounded as shown in Fig.1 and an edged corner (TE) is formed the angle of which is 90 to 120 degrees.

[0010] The tyre 1 in this embodiment is a radial tyre for heavy duty vehicles such as trucks, buses and the like.

[0011] The above-mentioned carcass 6 comprises at least one ply 6A, in this embodiment only one ply, of cords arranged radially at an angle of from 70 to 90 degree with respect to the tyre equator C and extending between the bead portions 4 through the tread portion 2 and sidewall portions 3 and turned up around the bead core 5 in each of the bead portions to be secured thereto.

[0012] For the carcass cords, steel cords are used in this example. But organic fibre cords, e.g. polyester, nylon, aromatic polyamide and the like may be used.

[0013] The belt comprises a breaker 7 and optionally a band.

[0014] The breaker 7 is composed of at least two crossed plies of parallel cords. In Fig.1, the breaker 7 is composed of a radially innermost first ply 7A and second, third and fourth plies 7B, 7C and 7D. In the first ply 7A, the cords are laid at an angle of from 50 to 70 degree with respect to the tyre equator C. In each of the plies 7B, 7C and 7D, the cords are laid at an angle of not less than 30 degree. For the breaker cords, steel cords are used in this example. But organic cords, e.g. nylon, polyester, aromatic polyamide and the like may be used.

[0015] When provided the band is disposed radially outside the breaker, and it comprises cords for which the cord angle is very small with respect to the tyre circumferential direction, for example, less than 5 degrees.

[0016] The tread portion 2 is provided in the ground contacting region 2S with main grooves G extending continuously in the tyre circumferential direction.

[0017] The main grooves G include two grooves Go disposed one on each side of the tyre equator C as the axially outermost main groove, and optionally an axially inner groove Gi disposed therebetween.

[0018] The tread portion 2 is further provided in the ground contacting region 2S with lateral grooves Y extending from the outermost main grooves Go to the tread edges TE, thereby a circumferential row of shoulder blocks SB is formed along each tread edge TE.

[0029] The present invention is suitably applied to heavy duty tyres, but it is also possible to apply to various pneumatic tyres for example passenger car tyres, light truck tyres and the like.

Claims

1. A pneumatic tyre comprising a tread portion (2) with tread edges(TE), the tread portion (2) being provided along each of the tread edges (TE) with a circumferential row of shoulder blocks (5B), characterised in that each of said shoulder blocks (SB) has an axially outer side face (10) which is convexly curved in a plane (K) parallel to the tread surface, said plane (K) including at least the top surface of the block (SB).

2. A pneumatic tyre according to claim 1, characterised in that the convexly curved axially outer side face (10) extends radially inwardly from said top surface to a radial distance which is not less than 60% of the height of the shoulder block.

3. A pneumatic tyre according to claim 1, characterised in that the convexly curved axially outer side face (10) extends radially inwardly from said top surface to a radial distance which is more than 80% of the height of the shoulder block.

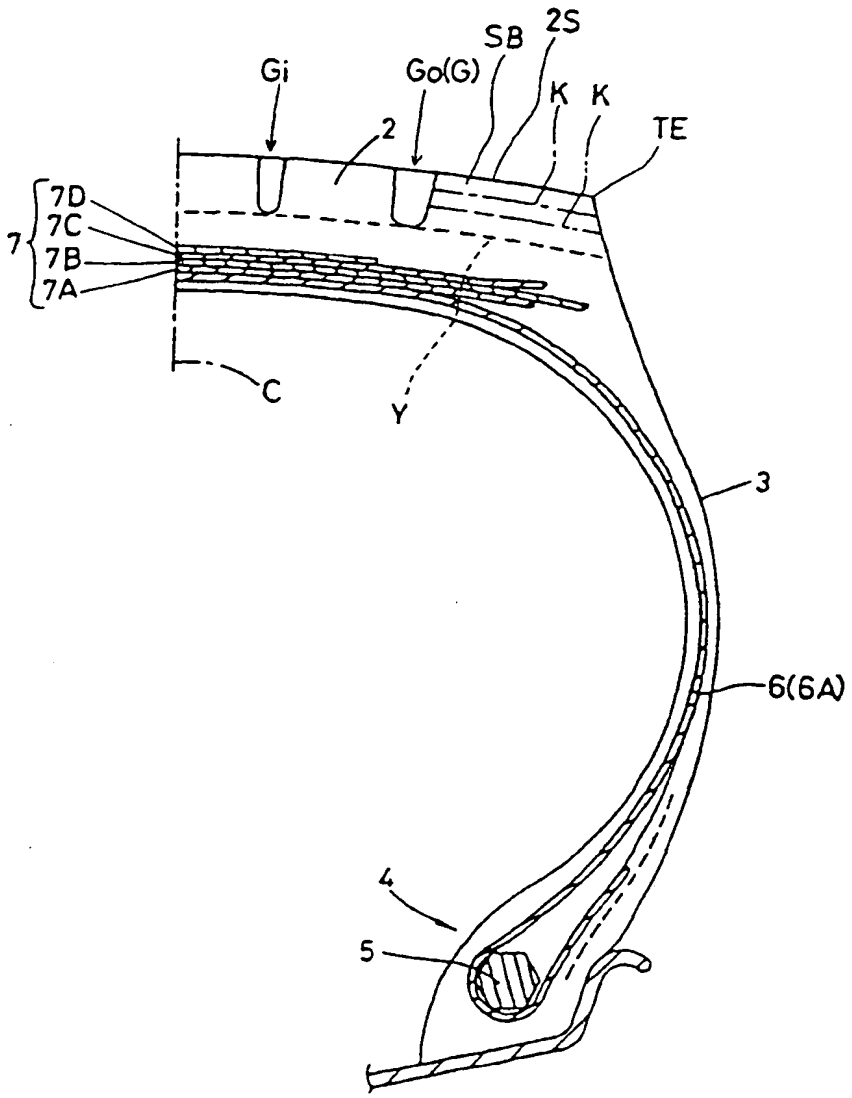
4. A pneumatic tyre according to claim 1, characterised in that the convexly curved axially outer side face extends radially inwardly from said top surface to the bottom of the shoulder block.

5. A pneumatic tyre according to any of claims 1 to 4, characterised in that the curvature (R) of said axially outer side face (10) has a single radius.

6. A pneumatic tyre according to claim 5, characterised in that said single radius (R) increases from the top surface towards the radially inside thereof.

7. A pneumatic tyre according to claim 5 or 6, characterised in that at the top surface of the block, said single radius (R) is in the range of from 0.5 to 1.4 times the circumferential length of the axially outer side face.

Fig.1



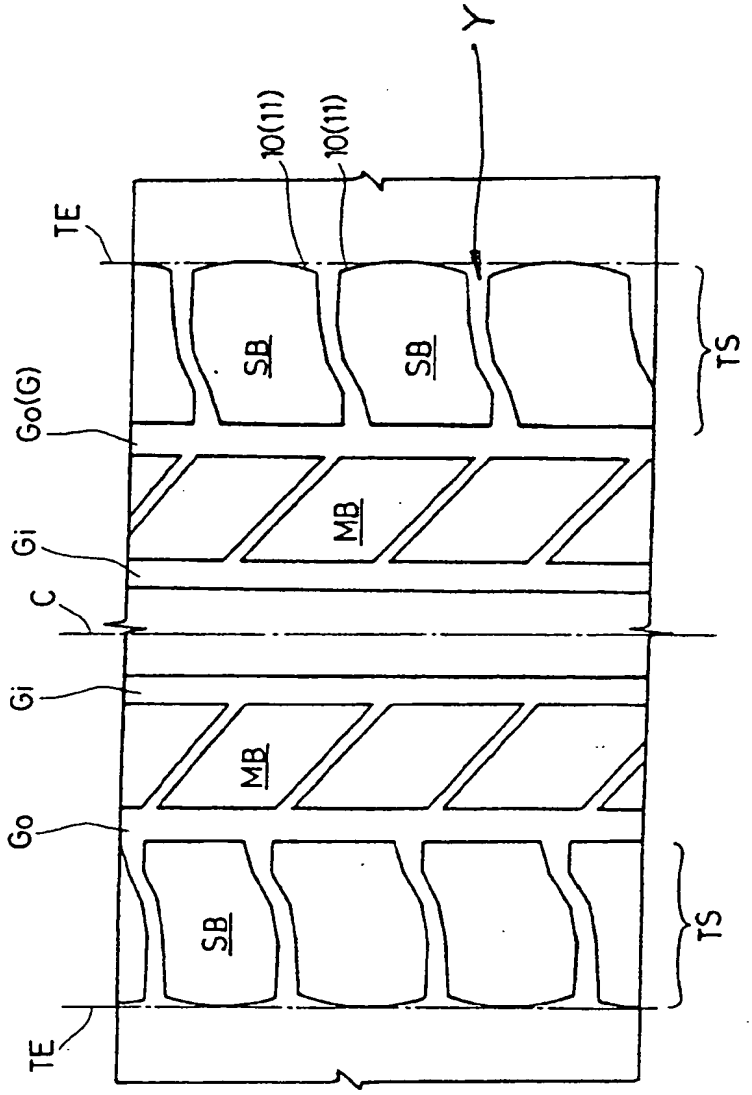


Fig.2

Fig.3

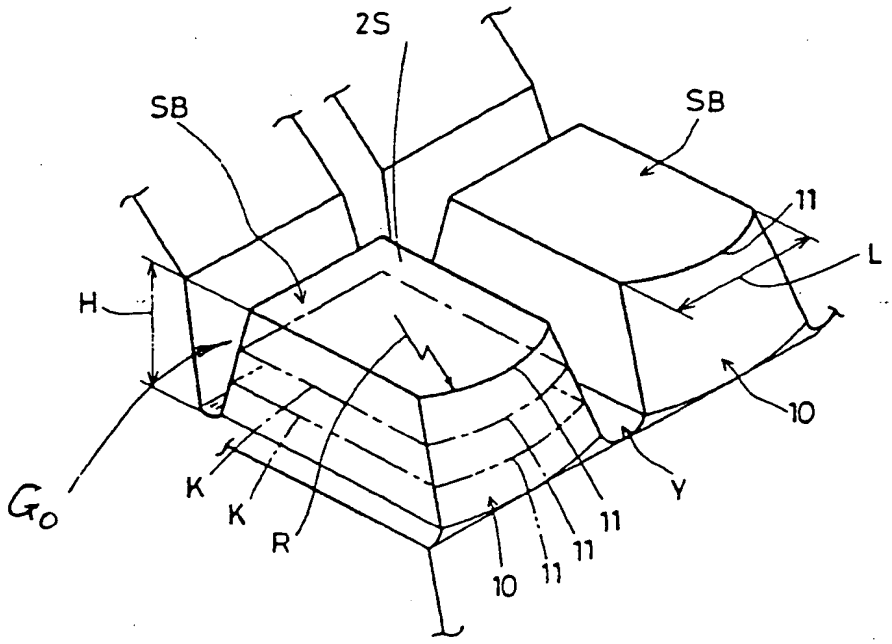


Fig.4

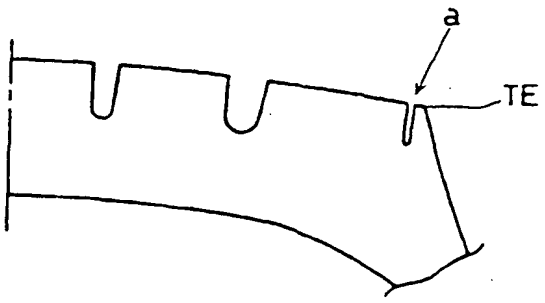


Fig.5

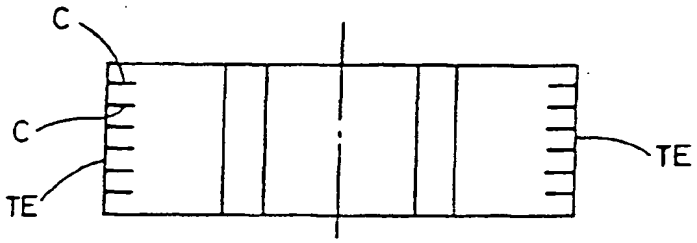
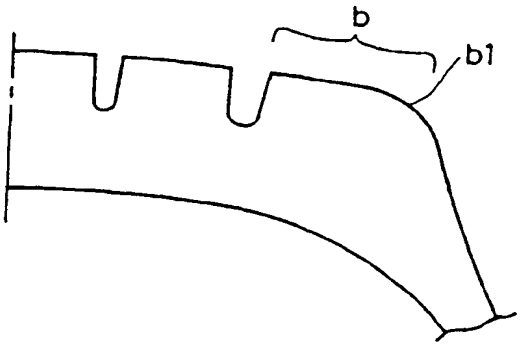


Fig.6



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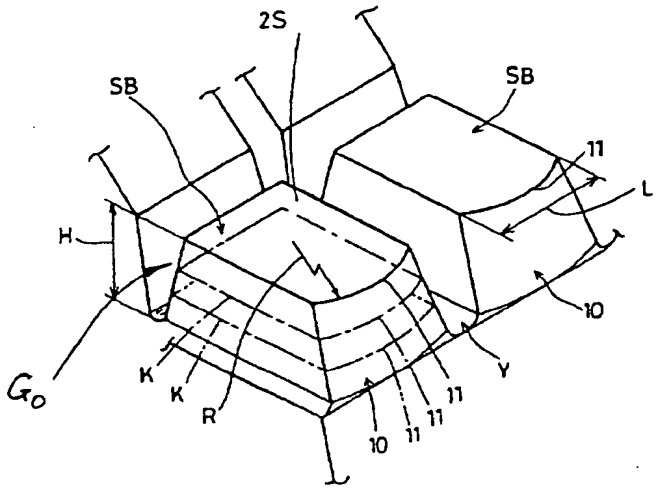

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EUROPEAN SEARCH REPORT

Application Number
EP 99 31 0169

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 322 107 A (LAGNIER ALAIN) 21 June 1994 (1994-06-21) * abstract; figures 2,3 * * column 3, line 1 - line 5 * * column 3, line 24 - line 45 *	1-7	B60C11/01 B60C11/11
X	US 4 667 718 A (FONTAINE JEAN F L) 26 May 1987 (1987-05-26) * abstract; figures 1,2 * * column 2, line 6 - column 11 * * column 2, line 18 - line 54 *	1-7	
A	US 1 956 011 A (EVANS RHYS) 24 April 1934 (1934-04-24) * page 2, line 103 - line 114; figure 5 *	1-7	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 February 2001	Boone, J

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